Margaret Deck

January 24

The Pine — Jan: 24.

Its Characteristics —

1. The Pine is the only English tree that is evergreen.
2. It grows high up, and very far north.
3. It's gymnosperm, or naked seeds.
4. It lived just before the geological age.

The pine tree grows very straight, and if the top be broken off, or blown off by the wind, it never looks the same again.

The wood of the tree encloses the new branches; this is easily to be seen in a fallen tree, when it forms a knot. Ex: 

Its Leaves —

The leaves are of a peculiar shape, unlike any others.

They owe their shape to several causes: —

a) the snow can easily fall through them;
b) the wind can blow through them.
c) they have a very deep sealed stomates to prevent rapid transpiration.

Adaptation of tree to its surroundings —

This tree is specially adapted to the sandy or chalky soil in which it grows, by having long and

spreading roots. It is not easily blown down, because of the nature of its leaves; they are so thin and spikey, that the wind meets with no resistance, or scarcely any.

Its Life History–

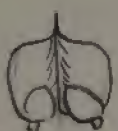
The life of a leaf, is generally from about three to five years. This can be seen by examining a stem; it is covered with scales which shoot off pairs of leaves.

The staminate flowers grow in clusters round the shoots.

The seeds are very well protected, and this is very necessary because if a pine-tree is once cut down, it never grows again.

The tree grows from fifteen to thirty years without bearing flowers; and altogether it lives for hundreds of years.

Seedling.



Cone scale at the line of pollination.

Pollen grain.

Scale from a two year-old cone.

Very fair

Table of Coniferae Trees.

- Pinaceae
  - Abietineae
    - Abieteae or Pineae proper
      - Abies = Fir
      - Picea = Spruce
      - Pinus = Pine
      - Larix = Larch
      - Cedrus = Cedars & Deodars.
    - Araucaria
    - Taxodieae
      - Wellingtonia & others
  - Cupressineae
    - Cypress
    - Juniper
    - Thuja or Arbor Vitae.
- Taxaceae
  - Yew & others

There are three trees that are very hard to distinguish from one another, and those are, the

spruce,
fir &
pine.

In a fir the cones grow upright, and in the spruce they grow downwards. In a fir the cones often have bracts sticking right out, whereas in the spruce there are no bracts that stick out beyond the others.
The general appearance of the two trees is a little different; the top of a fir is spreading and bushy, and the top of a spruce is sharp and spiney.
There are 20 spieces of firs, and 70 of pine.
The larch is another tree of this order, and it is the only one whose leaves fall off in the winter; it was introduced into England towards the end of the 17th, or at the beginning of the 18th. Century. Its wood is considered good for timber when it is forty years old; it is found to a height of 6000 ft. above the sea-level.
The juniper has male and female flowers, and its berries take two seasons to ripen.
The yew is supposed to be the longest lived of all the trees, some of them live to be two or three

thousand years old.

The Willow

Buds.

The characteristic of the buds is that they split up the middle; there is quite a division to be seen up the middle where the midrib is.

Flowers.

There are two kinds of flowers; —

1. pistilate.
2. stamenate.

The pistilate ones are green and rather silvery, while the stamenate ones are yellow and fluffy.

Leaves.

The leaves as a rule are rather long, especially in the Osier, and very often they rustle.

Species.

There are several species of willow, the principal being the Sallow, which can be distinguished by its number of stamens. It is the largest of the willows that grows in shrubs or bushes.

The Purple Willow is characterised by having its filaments joined together.
The Crack willow is so called because its branches crack so easily; it and the White willow grow to a height of 80 or 90 feet.
The Osier has long narrow leaves.

— " —

There are altogether about fifty-seven species of willows; they generally grow in damp places, or even in water. The flowers come out before the leaves. The number 2 is the number that characterises the willow.
The chief use of the wood is for weaving.

— " —

Poplars.

The poplars are classed in the same natural order as the willows, because their flowers are both dioecious; the order is Salicineae.
They resemble the willows in that they have their flowers early in catkins; they have downy leaves; they have no honey, so they have to depend on the wind to carry the pollen.
But they have more stamens and more carpels

than the willow.

Species.

The White Poplar has four carpels, and the Grey Poplar has eight; they are very much alike, and that is almost the only difference.
The Black Poplar is considered to have been introduced into England later than the last two mentioned. It is so called, because when it is cut down, a ring of black is seen in the trunk.
The Aspen is a true English tree; it has the same kind of leaves and flowers as the others. The wood was formerly used for making arrows.
The Balsam poplar is used for making packing cases, because it does not split.

Fairly good

— " —

The Hazel

Feb: 14.

The hazel generally grows in fairly dry places.

Shape- bushy.

Buds- rather blunt, red in colour.

Bark- very smooth and thin; in young trees it is of a very pale colour.

Stipules- there is a pair which goes to each leaf; they are remarkable in all timber trees.

Leaves- rough and round; they are doubly-toothed.

Flowers- they are of two kinds; - staminate and pistilate. The staminate flowers grow in catkins.

Fruit- there are two carpels; Generally one ovule grows, and the other dies off. It is dry, and indehiscent.

-One pistillate flower-

-One staminate flower-

-Stamen-

The Alder

The alder has an upright main trunk, and grows in wet and marshy places.

Buds- stalked purple

Bark- colour, black.

Stipules- they are to be seen enclosing the flower bud.

Leaves- they stay long after all the others have turned yellow; they themselves turn a lovely bronze colour.

Flower- there are two kinds, the staminate and pistilate, and both each form a bud. Each flower has a pair of stigmas

Fruit- it is carried about by water.

Wood- it is generally used for making charcoal; it lasts a long time under water, and so it is much used for making pumpsets. Scarlet pezizas often grow on their decayed branches. of hazel

-Two pistillate flowers-

-One staminate flower-

-Bud of the Alder-

Good

-The British Oak-

Feb: 21. 1910.

Natural Order- Cupuliferae.

Longevity- The oak dates from the chalk period, and it lives longer than any other. They have been known to live 900 years, and some probably longer.

Associations- It has a great many religious associations, chiefly with the Druids, and also with the Greeks.
In early English history we hear of it being used for shipbuilding, because of its knotty branches, which were found very useful for supporting the decks.
The value of a wood was often rated at the number of hogs the acorns of the oak trees would feed.

Distribution- It is found all over Europe, and in some parts of Africa and America.

Characteristic appearance- The knotted, knarled look of its branches is remarkable. The shape of its trunk something resembles that of a lighthouse; it is broad at the

bottom, and gradually curves smaller towards the top it generally twists a good deal. The reason that the trunk is so much bigger at the bottom, is partly because the branches are so spreading, and therefore are a great weight often

Branching- The branches are very knotty, and branch off at right angles from a larger one beneath.

Buds- The buds are yellow, conicle, and very well protected by the stipules which overlap them. The inside ones are hairy, especially at the base of the stipules.

Leaves- The leaves come out rather later than those of most trees; when they are damaged in Winter, new ones are produced in the following Summer.

Flowers- There are two kinds, pistillate and staminate. The male flowers and the female have green inconspicious catkins. The tree does not begin to flower until it is about sixty years old.

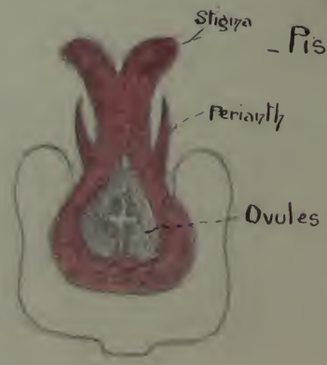
Fruit. The tree is so rich in tanning that the acorns are not very palatable. It is more infested with galls than any other tree, the most common are the

oak-apple, the marble gall and the artichoke gall.
The great value of the timber of the oak is its toughness and hardness. The bark is used for tanning.
When oaks are cut down they show a silver grain; there is one exception to this, and that is to be found in the Dunmast oak, which does not.

———— " ————

-Staminate Flower-

-Pistillate Flower-



-Cupule-

-Section through an older flower-

Good

-The Beech-

Feb: 28. 1910.

Natural Order- Cupuliferae.

Latin Name- Fagus sylvatica.

Characteristic appearance- The trunk of the beech is remarkable for its smooth stone-like appearance, and underneath the tree the ground is always bare. It grows to a height of about 100 ft.

Associations- In olden days it was always considered valuable on account of the nuts being food for pigs, deer etc.

Wood- The wood is capable of being split easily, and is chiefly used for making machinery, and mills etc.

Leaves- The leaves are very familiar to most people; compared with the Spanish Chesnut they are much smaller. They are decussate, ~~and this is the reason why~~ stipules they are so valuable for making hedges. because the leaves remain on all through the winter.

Flowers- The beech has catkins like many other trees, in both kinds, pistillate and staminate; the former grow in tufts, there are generally two, and each produces one seed; the latter grow in clusters, and

generally flower in June.

Fruit- The nuts of the beech have cupules.

-The Hornbeam-

The hornbeam can be easily told by its catkins: one of the bracts gives way to a larger bracteole with three points!
The tree is a native of England up to the line from the north of Wales to Norfolk.
It flowers in April.
The tree grows about 50 or 60 ft. high, it is smaller than the beech, and its twigs are very fine; the wood is very hard indeed.

-The Spanish Chestnut-

The spanish chestnut was introduced into England a very many years ago. It is not unlike the oak in many respects, only its leaves are much smaller, having long serated edges.
It has long catkins, the pistillate ones grow at the top of the stem, and the tip of the staminate ones hangs down. It becomes

mature at the age of twenty five, and is useful as timber until it is 50 or 60 years old.
Its average age is about five hundred years

-Beech-

-Spanish Chestnut-

-The Birch- -March 7th-

Name - Betula alba.

Natural Order - Cupuliferae.

Slenderness - The tree is very slender in shape, especially the twigs.

Growth - It generally grows to a fair height in woods, but in the open not very high. In the Arctic regions it is only a shrub. Its roots go very deep down.

Distribution - It grows all over Europe, the Russian Empire, Finland, Greenland, and Iceland; it is the tree that grows nearest the Arctic regions, because it is so hardy.

Bark - The bark is of a lovely silver colour, and is very useful. In Finland it is used for all kinds of purposes; for making tubs, shoes, houses, ploughs, dishes, spoons etc, because it is found

to be so durable. When books are bound in Russian leather, it is said to be the oil of the birch which prevents them from going mouldy.

Flowers - It has both pistillate and staminate flowers, and they come out about a month before the leaves. When in bud, they are stiff and stand upright; they have red styles. On one scale of the catkin there are three flowers. Each flower produces a winged fruit. Both kinds of flowers are cymes.

Age - It matures in 50 years, and dies in 50 more; flowers from 10 or 15 years to 25 years, and afterwards every subsequent year.

-Pistillate flower-

-Winged fruit-

-The Elm-

Family- It is of the same family as the nettles, and the hop.

Two species- There are two species, the Wych, Ulmus montanus, and the Common, Ulmus campestris, which is not known north of Leicester.

Flowers- There are no catkins, all the flowers are perfect.

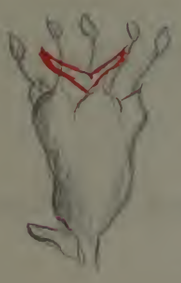
Buds- There are two kinds of buds, flower and leaf. The stipules cover the bud, and each bud scale is made of two stipules joined together.

Leaves- When the leaves are young they hang down. In the two species the leaves are of different shapes, that being one of the greatest distinctions. Those of the wych elm are the largest.

Wood- There is a great deal of cork on the trunks,

especially on young trees. It does not rot under water, and therefore is used for making pipes, tool-handles etc.

Age- It lives to the age of 500 years, and seeds at 30 years. Its great enemy is the Scolytus destructor, which bores its way up the bark.



-Perfect Flower-

-Wych-

-Common-

Fruit of

Good

The Sycamore — March 14th.

Natural Order — Sapindaceae.

History. The sycamore has been introduced into England since the 15th century.

Appearance. It is a very strong tree, and is not influenced by winds, not even by strong sea winds; it also gives very good shelter. The tree does not begin to flower until it is twenty years old; until then the branches are stiff and regular, afterward, they begin to shoot.

There is a great deal of red colouring in all parts of the tree. The young leaves are sometimes quite bright-red, and their leaf stalks are pink; the scales also, are red instead of green.

Bark. In young trees the bark is quite smooth, but in older ones it splits rectangularly.

Leaves. The leaves are fairly large, and pointed, but they are slightly curved, and this is one of the distinctions from the plane trees, which have

their leaves very sharply pointed. with concave curves.

Buds. The buds are very well protected with scales; there are no stipules.

Flowers. The flowers are ~~quite~~ perfect; they are not brightly coloured, but are chiefly green and yellow, and they hang down.

Seeds. The seeds are very carefully protected, and this might account for the very rapid spread of the tree. If they cannot germinate in twelve months, they die.

Fruit. The fruit is winged, and it is scattered by the wind.

The Norwegian Maple — Acer campestre

History. The Norwegian maple was introduced into England in 1680, it is the only English one.

Flowers. It differs from the sycamore in that the flowers grow erect, the buds are more red, and the leaves are more pointed.

Leaves.

Use. It is very often used in the south of England for making hedges. When it is cut, it sends out red shoots.

Wood. Its grained wood is used largely by cabinet makers; it is also used for making pipes.

---

i8 p23 Bots CM32

The Horse Chestnut- Aesculus hippocastanum.

Appearance. The horse chestnut is remarkable for its very large and sticky buds, and in consequence the branches are very thick and firm; the stalk is .3 in. in diameter below the 6th leaf bud.

Leaves. The leaves are palmate, and they have a large amount of resin on them.

Fruit. It has a green sort of capsule, in which are ~~brown fruits~~, and big seeds.
It is the favourite food of the deer, and is much used for fattening sheep.

Stipules. It has no stipules.
It was introduced in the 16th. century from North India.

Fairly good

---

i8p24 Bots CM32

The Ash- Fraxinus excelsior-

The natural order is Oleaceae.

The ash was very important in the mythology of our forefathers. The word ash comes from the Saxon word "aesc", meaning a spear.
It grows in districts where there is plenty of water to be found, and it likes loose porous soil. Its roots grow in a remarkable way; they stretch out horizontally, then downwards, thus using up all the nourishment in the soil, so that nothing can grow under their shade. They very often grow near a stream. They are found all over Europe, even in the Alps; and when they are not cut for making shady hedges, they grow to the height of about 100 ft.
The chief characteristic of the tree is its black buds, and this makes it easily distinguished from other trees.
In the buds there are both leaves and

flowers, but the latter come out the first.
The bark is ashen grey in colour; the wood is used for making gymnastic apparatus, poles, handles of brooms and tools, ladders etc. It only comes second to the oak in this respect. The young shoots are used when they are thick enough in diameter.
The flowers are numerous, and purple in colour. Some of them are perfect, containing of the essential parts, the pistil and stamens, while others only have stamens, and again, others only the pistil.
The pistil is double, but only one seed is produced.
The seeds are sown by the wind, and this is essential, because as nothing grows under the tree, they would not grow unless they were scattered some way away.
The fruit is a samara.

———

-The Lime- *Tilia platyphyllos*.

The natural order is Tiliaceae.
The chief characteristic of the lime is its scent.
The tree generally grows from about 80-180ft in height.
The wood is valuable for being soft and close grained, but it does not seem to be very durable. Grinling Gibbon's carvings done in it, and those which are in Kensington palace have had to be painted to keep them from decaying. The soft layers under the bark are remarkable.
The buds are opposite, and it is very curious that the terminal one should wither and fall off.
It is the habit of all trees to flower; the flowers are grouped together, and their perianths and pistils are attached to a short stalk.
It is stipulate.
The ~~buds~~ are red on the upper side, and green on the lower;
One lobe of the leaf is larger than the other, and in one species the shape is cordate.

———

Fairly good

-Rosaceae-

March 28 lt.

Many of our British flowering trees belong to this order, such as the

1. Prunus spinosa, or sloe,
2. " Avium, Gean, or wild cherry,
3. " Padus, or bird cherry.
4. Hawthorn
5. Blackthorn. same as 1
6. Pluem.
7. Damson.

The Prunus spinosa or sloe is remarkable for its quantity of fine interlacing twigs. The damson and pluem are derived from it. It is very difficult to distinguish from the hawthorn before the leaves are out, but when they are out they are very easily distinguished because they are simple, while those of the hawthorn are incised. It has to produce a great many flowers because so many of them fall off before the fruit is formed. The fruit is

enclosed in a very tough skin, and it is palatable like all fruits of this order, but it is generally only eaten by birds. It is very acid before it is ready, and this is to prevent it being eaten before the time. The seeds are enclosed in a hard shells.

The Prunus Gean or wild cherry grows higher than some of the other trees of this order, and it is generally about 30 or 40 ft. in height.
It is easily distinguished by the rings on its bark, which are formed by cork cells. These cells are packed closely in Winter, and loosely in Summer when the work of the tree is going on.
Lenticels are the stomata through which the tree breathes; they are to be found on the twigs as well as the bark.
Some of the buds produce long shoots with long internodes, and some produce five or 6 little buds all in a group. The outer scales on the leaf base are formed of two stipules and a short sheath.

The Prunus Padus or bird-cherry is often to be found growing on the banks of streams, but it is also found in dry places. The trunks and branches are slight, and the tree is often deformed. The young wood is beautifully stout and strong. It can be distinguished from the plum by the way the leaves are rolled in the bud. Those of the cherry are thus: — 

plum " " wood

Grasses. April 25th.

Grasses have certain peculiarities which distinguish them from other plants.

1. The character of their leaves. They have a sheath ~~or ligule~~ enclosing the stem. Its use is disputed by different authors, some say that it is to prevent the water from running ~~away~~ down the stem.
2. The flowers are in a panicle, and have eight stamens with versatile anthers, and two feathery stigmas.
3. They have a flowering stem, or haulm.
4. The seed is very easily separated from the chaff.

The flowers of the grass are in a spikelet.

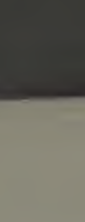
Those grasses that are useful for food are the following: —

rye grass,
Italian rye grass,
cocks foot,
meadow fescue
meadow fox-tail
crested dog's tail
rough and smooth meadow grass
sheep's fescue

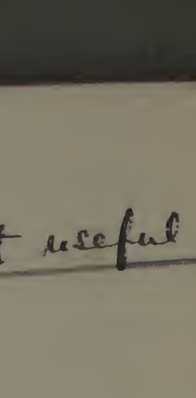
Those which are not useful are:——

wild oat,
hair grass
mat grass
false brome
couch grass
Yorkshire

A.



B.



Flower of meadow Fescue from which the outer pale has been removed.

C.

Expanded spikelet of the Oat.

G = glume
P = pale
A = awn

Very fine

-Ferns-

May 2nd.

Ferns are usually found in shady places, but there are some that do not seem to mind the light, and such those are the polypodium, bracken, and filmy ferns.

Ferns are all different sizes, and each species grows in different sizes.

The shape of the fronds is also quite different; some of them are indented right up to the stem, while in others, such as the polypodium, the fronds are indented, but not right up to the stem.

The typical shape is that of the bracken.

There are no buds to be found in ferns; except in one kind, and they can be picked off, and grown.

The growth of all ferns is herbaceous; they come up every year, but not in exactly the same place, because every roots are sent down, which produce and send up new fronds. When the new

fonds are coming up, they are curled, and covered with brown scales.
The stems have vessels in them.
The life of a fern is very much like that of an ordinary flowering plant, but the history is different.
The way in which ferns are produced is the following: —
On the back of ferns masses of spores may be seen these spores are enclosed in vessels called sporangia. When the spores are ripe they swell, and burst the sporangia, and scatter themselves; then the scattered spores each produce a prothallium, which grows into a new fern. The sporangia are grouped in masses, each mass being known as a sorus. Each spore from a given fern is the same size.
Ferns are called Cryptogams to distinguish them from flowering plants.

Very fair

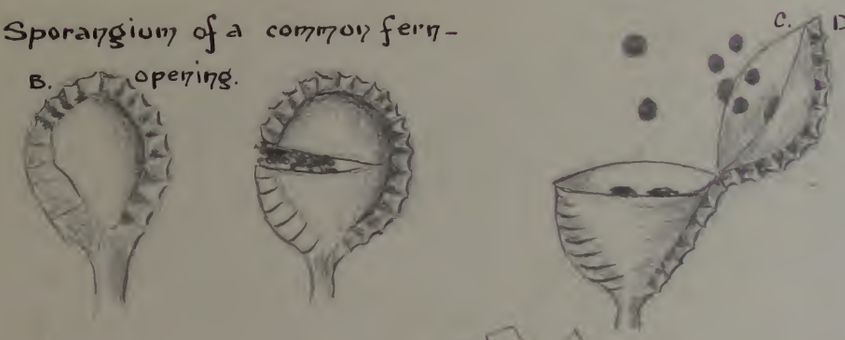
Special spore-bearing plants.

Hard fern
Parsley fern
Osmunda regalis
Moonwort
Adders tongue.

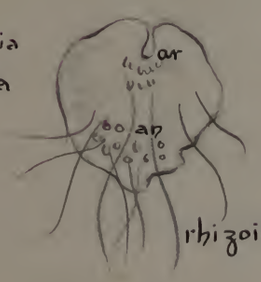
———— " ————

-The Sporangium of a common fern-

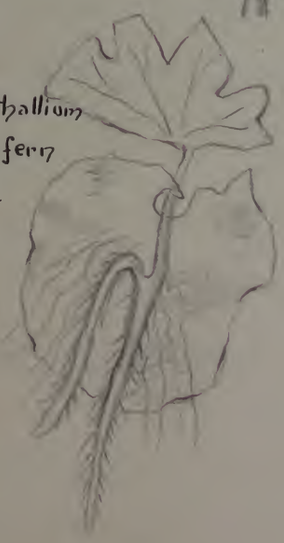
A. closed. B. opening. C. Discharging spores.



(ar)archegonia
(an)antheridia



old Prothallium with young fern attached.



Sperm

Section through a sorus at right angles to surface of leaf-
showing indusium (i)
and sporangia (s)

Observing excellent

Vascular Cryptogams — Mary

Horsetail

The horsetail grows in all kinds of places, but chiefly near water. It is always found growing, where others plants will not grow, this is because it is now dying out, and has to grow anywhere it can find room.

Its golden age was the coal period; it was then growing to an enormous height compared to its present height, some stems were five feet thick, almost like trees.

There are altogether eleven species in Britain, the four best known being the

1. field or common
2. wood,
3. marsh
4. giant.

The latter sometimes grows to a height of six feet, it generally grows in chalky places. The horsetail resembles a fern in the way it sends down fibrous roots, which send up stems. The shoots on the stem corresponds to the fronds of the fern. In the stem

grooves are to be found, and in them are the stomata, which are very deeply seated because as the plant grows away from water, it is important that what water there is, should be protected.

Hanging down from the cone, there are little spore cases, which enclose the spores. Before they are ripe, they are closely packed together, so that no dampness can penetrate, but when they are ripe they are separated. Each spore has its outer skin cut, so that it divides into four kind of ribbons called elaters. These elaters often look several spores together, and they act like springs, so that the spores are able to move about when the atmosphere becomes warmer; for instance, when they are breathed upon.

There is a single cell which divides and sub-divides, until it forms the prothallium, and on the prothallium, organs begin to grow on the under side. All the spores are the same size; but some produce the prothallium having egg pockets, called the archegonia, and others only sperm pockets, the antheridia.

These two kinds may be found quite close together, but they cannot grow from the same spore. The germination is usual, and

consequently very difficult to watch.

-Horsetail-

two views of the "spore-leaves", showing the group of sporangia.

Aspore with the elators coiled around it.

uncoiled.

Club Mosses. May 16 th.

commonly found here

There are three kinds of club mosses, the

1. Lycopodium clavatum, or stag's horn moss;
2. " Selago, or fir club moss;
3. " alpinum, alpine club moss.

These three kinds are all spore bearing plants. In the Common, or stag's horn, the plant sends up special spore-bearing fronds, which form the clubs by which the plants derive their name. In the alpine club moss, the spore cases are in a light cluster at the top of certain branches.
In the Fir club moss the spore case is at the end of each leaf, and it splits to let out the spores.
The common, or stag's horn club mosses, spread more by growing and sending out branches, than by spores. The spores of

these club mosses are often called

"vegetable brimstone" because of their sulphur property. They are used in making fireworks, and also for coating pills.

The peculiarity of the Selaginella is that it produces spores of two different sizes; the microspores produce a prothallium with female organs, and the macrospores a prothallium with male organs. The former begin to develop before they are broken off from the old plant, and the latter are produced on the upper leaves.

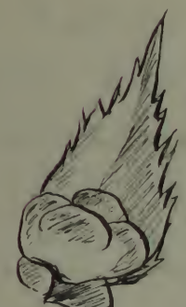
Trees to the height of 100ft. belonged to this species in the coal age.

The root of the Sigillaria is called the Stigmaria.

- Club Mosses -

- Sporangium of the Fir Club Moss -

Diagram of longitudinal section of the CONE of Club Mosses -



- Microspore and - Macrospore of Selaginella selaginoides -

- Diagram of section of the cone of a Selaginella -

Mosses. May 30 Ltr.

The most important work of mosses is to make soil in barren and rocky places, where it otherwise would not exist.
The soil is made by the under leaves of the moss dying, and making mould, in which insects etc. congregate.
There are five ways in which mosses make fruit: —

1. Those which grow upright, with their fruit on the top of the stem, called top-fruiting or acrocarpous;

2. Those which spread by creeping along the ground, called side-fruiting, or pleurocarpous.

Bog mosses make their fruit in a third way.
The polytrichum is a top-fruiting moss.
Its root is fixed in the ground by threads.
The water gets into the plant through the leaves when it runs over them, by means

of small hairs or pouls. If the stems are long, the water runs up by capillary attraction.
seta The stem is called the seta; on the top of it there is a capsule, containing the sporangium.
operculum When it is ripe, the hood or operculum, falls off, leaving many teeth which act as a sift for the spores to fall out; in this way they are well scattered. The spores are shaken into the ground by the side of the parent one, and the prothallium is produced in the form of fine green threads, on which buds arise, which form the new plants. On them the archegonia and antheridia grow, and they can either both grow on the same stalk or on different.
antheridia

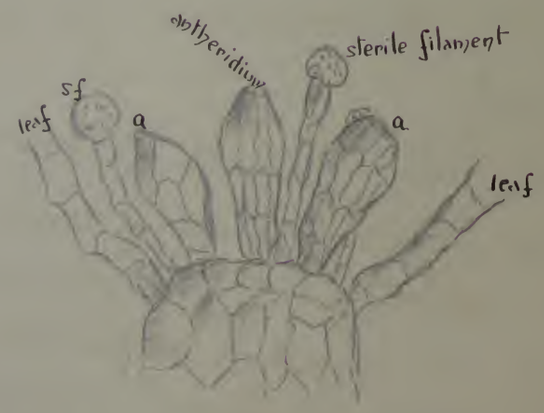
Resemblance with ferns and horsetail.

In mosses, the leaves correspond with the prothallus part of horsetail and ferns; the stalk of the capsule with the club of the horsetail and the fronds of ferns; moss has got no vessels in the stem.
In the polytrichum the green part is one

fernalion, and the stalk and capsule another.

Prothallium or protonema of a moss-

- Female shoot with young fruit-



Section through the tip of a male plant-

Female plant just before the archegonium is torn away and carried upward as the calyptra-

- LIVERWORTS -

Liverworts are nearly related to mosses, the Pellia is a typical one. It has green fleshy leaves, which lie flat on the ground, ~~and~~ the stalk of the spore case grows out of the leaves, and it has a black thing like a pin's head on the top which bursts into four, and brown spores come out. The stalks are not very visible, because they very soon shrivel up.

The leaf is composed of: —

1. the leaf-surface,
2. an empty space with chlorophyll,
3. air cells, which are not very distinct in the Pellia.

Liverworts live chiefly in water, and damp shady places. Sometimes they are found in pools of water, and sometimes in shady places, without much water.

There are two forms of reproduction,

1. sexual, with archegonia and antheridia,
2. vegetative, with the spore growing on

the leaves.

Liverworts are divided into two classes: —

1. frondose, having fronds, and resembling lichens;
2. foliose, having leaves, which make it resemble mosses.

It resembles mosses in that it has no vessels in the stems; ~~capsules opening~~ with a lid; it has spores; and it is unlike mosses lichen because its capsule splits into four, and its leaves have an upper and an under side.

Liverworts are divided into four families.

1. Jungermanniaceae, having stalked capsules splitting into four, and including leafy liverworts, also frondose species.
2. Marchantioseae, including frondose liverworts, ~~and those~~ having male and female receptacles.
3. Ricciaceae: floating or submerged.
4. Anthocerotaceae, which grow on clay, and ~~can live only on water.~~

Four

Fungi. June 20th.

Characteristics.

The chief characteristics of fungi are: —

1. They have no chlorophyll, and therefore ~~they are~~ not green like other plants, and therefore cannot obtain food from the air. They get it from the ground, by
2. feeding on decaying vegetable matter, when they are called saprophytes; (sapros = rotten) or by living on living matter, when they are called parasites.

There are many more fungi belonging to the former than to the latter.

3. Some of them bear spores underground, while others bear them above ground.

The visible part of the plant is the least essential.

Life History.

In mushrooms there is a network of threads called mycelium, and on the end of each thread there are four spores. In mould there is only a single spore on each thread. In the mushroom, the gills are covered

naked spores, which drop and form the new plants.
Mushrooms have two harvests, one at the end of September and October, and the other at the beginning of Spring. They can produce new spores for five years, and then be exhausted.
The reason why they wither so soon is because they are largely composed of water. Many mushrooms are classified by the colour of the spores. If they are brilliantly coloured, or if there is a ring at the bottom of the stalk, they are poisonous.

Classification.

I Basidia fungi, which are divided into two classes: —
  a) rusts and smuts
  b) naked spores, exposed as the mushroom.
II Sac fungi, including mildews, caterpillar and club fungi, and truffels.
III Alga-like mould.

IV Yeast or budding fungi,
V Bacteria.

- Lichens -

The meaning of the word lichen is full of life. Lichens can be obtained at any time of the year, but their condition varies with the weather. In wet weather their colour changes, it loses some of its brilliancy, and after there has been a drought, they are quite brittle.
They are quite distinct from mosses, in that they have no distinct stem or leaf, therefore they are called thalli. Lichens are divided into four groups, which are the following: —

1. Crustaceous
2. Foliaceous
3. Shrubby lichens
4. Jelly like "

1. The Crustaceous lichens are divided into several, among which are the following:

a. Lecidea, the chief feature being the beauty and colour of the forms of reproduction. The spores are scattered by the wind, insects etc.

b. Lecanora.

c. Graphis. This kind is a very curious one, and gets its name from the fruits which are long and narrow, forming curious shapes resembling letters.

2. The second group, Foliaceous ~~is divided into:~~ — includes the following

a. Physcia

b. Parmelia, a very common kind.

c. Pelligera, which grows everywhere on walls. It sends off kinds of small shoots by which it clings; it used to be considered a cure for hydrophobia.

3. Shrubby lichens are the third group, which are divided into: —

a. Cladonia, including reindeer moss.

b. Old Man's Beard.

c. Evernia.

Sometimes in Continental forests it exceeds

a yard in length.

4. The fourth group, that of the jelly-like lichens are so transparent, that they are easier for microscopic investigation that the others.

There are also fifteen hundred species in Ambleside.

Internal Structure.

There are two kinds of cells; —

a. transparent, which absorb the water needed,

b. green, which obtain the sunlight required.

It is by these two means that the lichen manages to live.

Method of Reproduction.

New plants are produced by means of spores, which fall to the ground, and the new plants spring up.

Lichens do a great work in the economy of nature, by covering rocks, and making soil for mosses to grow in. They grow in places where nothing else will grow.

The Fall of the leaf. Sep. 28th.

1. The leaf - its structure.
The leaf is composed of the epidermis on the upper side, and on the under side, the stomata, and other cells below, composed of a spongy tissue.
The function of the leaf is 1. for transpiration; 2. respiration, and 3. for assimilation.
Through the leaves oxygen is breathed in, and carbonic acid gas breathed out, they are the lungs of the tree. It is a curious fact that leaves fall off, when they act as lungs to the tree, but when their work is done, they all come off, though in different ways. Some of them, and in this climate most of them, fall off once a year all together, whilst others, such as firs and evergreens loose their leaves separately, and so they are not so noticable.
2. Reason for the Fall.
The reason why leaves fall off the trees, is that they are affected, in the first place, by the climate. The frost freezes them, the snow settles on their broad surfaces and damages them, and the wind blows

them off. Their fall is also due to their having finished their work, and therefore as they are no longer wanted, the tree dispenses with them.
3. Preparation for the Fall.
In the Autumn, it will be noticed that most of the trees change their green leaves into brilliant coloured red and yellow ones, which eventually often turn into brown. This is caused by the chlorophyll, which gives the green colouring to the leaf being withdrawn.
It is a curious fact, that in some trees, as in the maple for example, the leaves are red when they first come out, as well as in the Autumn.
When the work of the leaf is done, the tree draws all the juices from it, and stores them in the stems.
The leaf then falls to the ground, and decays, and fungi live on it. It eventually is just a skeleton.

Very fair

The Rabbit

Jan: 23. 11.

The Rabbit is to be found in great quantities in Europe. In Great Britain there are forty species, in Ireland twenty two, and in Germany as many as ninety.

wild generous wild animals

The wild rabbit seems almost a native in this Country, but it was originally introduced from the western shores of the Mediterranean.

I Habits.

Rabbits live in warrens, generally of sand, in which they burrow. They have a very keen scent, being able to smell their enemies very quickly. Their white tails are used as a guide when they are following each other about in the dark. Their holes where they keep their young are open only at one end, which they fill with earth when they are absent, to prevent the fox finding the nest. They spread very rapidly indeed, two rabbits producing as many as 13,718,000 in three years. They live chiefly on grass and herbs.

When they walk they plant the whole of their foot on the ground. The track of their foot-prints is seen thus:—

: : hind feet

:

: fore feet.

II Appearance.

Their ears are long, and always upright, as they depend much upon their sense of hearing. Their eyes are placed well to the side of their head, so as to enable them to see well round in all directions; they have three eyelids. Their whiskers are used as feelers. They are covered with ~~with~~ fur which is largely used in manufacture. Young rabbits have no fur, only skin.

III Skull & Teeth.

In the upper half jaw there are two incisors and six molars; in the lower, one incisor and five molars.

IV Relations.

The animal the most nearly related to the

rabbit, is the hare.

Rabbit = Lepus Cuniculus
Hare " Europaeus
Mountain Hare = " timidus

Rodents

The characteristics of Rodents are that the incisors are their best teeth, because they are gnawing animals; they have great powers of running and jumping, they are vegetable eaters, they are covered with hair and are quite harmless except to crops.

The Squirrel — Sciurus vulgaris

Nearly everyone knows the little brown furry animal, the squirrel. It is found almost over the whole of Europe, living in a temperate Climate. The American species is nearly related, but it is a different species. The squirrel lives chiefly above ground, and is often to be seen running up trees, a springing from one to another. It lives on nuts, birds eggs, cones and bark, the former of which

it stores up for the winter.
Its nest is made of sticks, woven together with hair, and is generally found in holes, or in ~~branched~~ forked branches.
The little ones are helpless, naked and blind, and are generally born in June.

The Beaver — Castor fiber

There is no historical record of the existance of the beaver in England, but we have remains in the names of places, such as Beaverbourne, Beverley, and Beavers Rockets.
In Cardiganshire in 1138, we hear of their existance. They are preserved in Norway, but are dying out in Siberia and Russia. They live in water, to which they are especially adapted by possessing the power of closing their ears and nostrils when under it, and their tails are broad and flat. Their hind feet have webs, and sharp claws, and the soles of their feet are scaley. They are said to have taken to water to escape carnivorous animals. Their chief enemy is the otter.
Their houses are made of mud and wood, the little ones living in them until they are three years old.
It is incorrect to imagine that a dam is

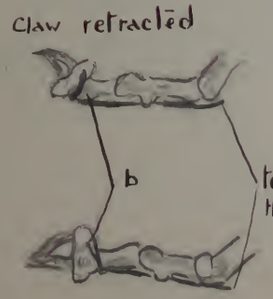
made by more than one pair of beavers, which is not the case. The reason that dams are made, is that the beaver wants to dig out the bed of the stream in order to make the water deeper, so that in cold weather when it freezes, he will still have some water to be in.
A certain oil called castoreum which is used abroad is made from the beaver.

The Dormouse-

The dormouse is of much the same colour as the squirrel, but it has bright black eyes, and it sleeps all through the winter. Its internal organs differ somewhat from the Rodents; their feet are very beautiful.

-Cat-	-Dog-
Fur	Long Hair.
Extended pupils	Round pupils.
Independent	Easily tamed.
Solitary	Sociable
Retractile claws.	Sharp claws.
Hunts by springing	Hunts by snapping
" stingly	" in packs
" stalking	" by scent
" cluttchy	
Dainty feeder	Hurried feeder.

-Toes of a lion-



b. the tendon by which it is pulled back.

Wild Cat - Felis catus -

Larger, fiercer, longer tail, larger head than ordinary cat. Chiefly found in highlands of Scotland. British animal, found last in Wales in 1850. Feeds on rabbits etc. Fur beautiful and valuable, probable cause of extermination.

Wolf - Canis lupus -

Last found in England in reign of Henry VII, in Scotland 1743, in Ireland 1766-1770. Hunt in pairs, except in Winter, when hunt in packs. Feed on deer etc. when obtainable, when not, on rabbits, hares, crustaceans, snails.

Fox - Canes Vulpes -

Size of small collie dog; brown, much hunted because of his keen scent. Very cunning and sly, destructive; hunts by night. Pupils slightly elongated. Specially fond of beetles, insects. Four - six young ones.

Carnivora -

Food - teeth - canine - cutting edge of cheek teeth.

Claws - tibia and fibula free - collar bone reduced - digitigrade walk

---

Feb: 20th.

Seal -

Two species, common and grey. Former found in most parts of the coast of great Britain, latter chiefly a native of the Shetlands. Lives in the sea, except in breeding season when chiefly on land, except when fishing. Feeds on fish. Adapted for life by thick oily skin.

Bear -

Colour differs, some dark, some light brown. Now extinct in England. Feeds on honey, berries and roots. No tail. Easily tamed. ~~First and fifth digit longest.~~ Five claws. Sense of hearing not keen. Plantigrade.

Mustelidae-

Pine Marten - Mustela martes-

Lightish brown colour, rare, resembles cat in shape; body 17in. long, hunts by night.

Polecat - Mustela putorius.

Fierce and ~~blood~~ thirsty; like a fox in shape; hides during day amongst rocks or in rabbit holes, hunts during night.

Mustela Vulgaris - Weasel-

Light brown in colour; ~~changes to white, though seldom in England~~. Smallest member of tribe.

Stoat - Mustela Erminea -

Lives in rocky places; dull mahogany brown, white underneath; in snowy parts of England changes to white.
All tribe live on rats and mice, some on snakes.

Badger - Meles taxus-

Found in certain parts of England - Yorkshire, Dorsetshire. Live in burrows, vegetarian. Pale grey, dark underneath. Very retiring.

Insectivora- March 6th.

Hedgehog - Erinaceus Europaeus-

Easily recognised by covering of spines; each one attached to skin by small ball having a muscle enabling the animal to draw them in at will. Mouth like a hog - hence its name. Teeth like other members of Insectivora.
Feeds on - rats, mice, snakes, roots, insects etc.
Seen generally at night. Very silent, only occasionally squeaks. Lives on banks and in hedges. Young ones white, having soft skin and soft spines and also being blind for the first few days.
Plantigrade.

Common Shrew - Sorex vulgaris -

Brown, about size of mouse. Lives in hedgerows all over England. Useful scavenger; lives on earth worms, slugs, insects, and all decaying matter. Move in a remarkably quick manner. Live in holes in the ground lined with leaves. Attacked by owls.

Pigmy Shrew - Sorex pygmaeus -

Not common in England, found more often in Ireland. Much smaller than Common Shrew.

Water Shrew - Crossopus fodiens -

About $3\frac{3}{4}$ inc. in length; live in streams and pools, feeding chiefly on shrimps. Black in colour. Stiff hairs on tail.

Insectivora compared with Rodents.

Although the Insectivora are so named, small, fur-covered, and accustomed to live in the water, they differ from the Rodents in that they eat insects instead of animals.

Chiroptera - Bats March 13th

Classification - Live on insects, but divided from Insectivora because they have wings; ~~Are because~~ warm-blooded, have fur, young born alive and suckled; hence they are mammals.

Compared with bird - Differ from feathered, biped, non-hibernating bird, being quatruped, hibernating, and having no feathers.

Wing-Skin - Wing has same bones as other animals, but covered with peculiar kind of skin; which in some cases covers nose and ears as well, enabling the animal to see in the dark, though blind. Has same bones as other animals. Knee-joint peculiar - bends opposite way to that of other animals.

Knee-joint -

Teeth - Teeth sharp for insect-eating in most cases, but some bats are blood sucking and fruit eating, then teeth modified accordingly.

Food - Food - Chiefly insects, & some species, fruit.

Hybernation - Hybernate in Winter.

Hibernate.

Vespertilionidae.

Pipistrella	Vespugo	pipistrellus
Noctule	"	noctula
Hairy-armed	"	Leisleri
Serotine	"	serotinus
Long-eared	Plecotus	auritus
Barbastelle	Synotus	barbastellus
Daubentonus	Vespertilio	Daubentoni
Reddish Grey	"	Nattereri
Bechsteins	"	Bechsteini
Whiskered	"	mystacinus

	Pipistrelle	Noctule	Serotine
Size	1·65 WS 8½	3" WS. 13-14	Large
Haunts	old buildings and roofs	Tree tops	Tops of forest Trees
Food	Gnats	Cockchafer	
Flight	Swift & rapid Sudden turns	High and Straight	Slow & fluttering
Locality	Common	April - September	Alone

should receive preferred larger drawings

Long Eared Bat.

Head & body 2 inches. Wing span 10 inches. Ear 1¾ inches. Brown, paler underneath. Has inner and outer ears. Eats night moths.

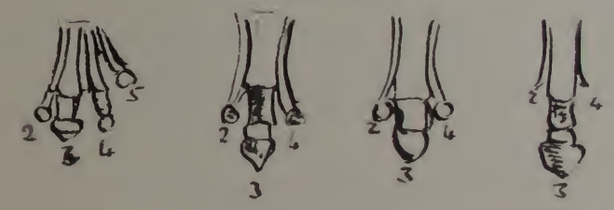
Barbastelle.

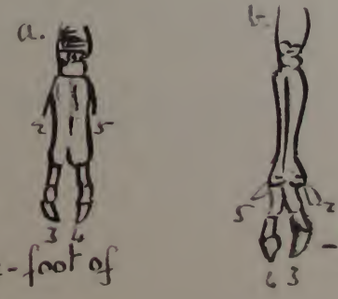
Head & body 2 inches, W.S. 10", ear ½".

Ungulata.

From ungus, a hoof; all hoofed animals, digitigrade, and very fleet of foot. Feeders chiefly all vegetable feeders, hence their grinding teeth. They live in herds in plains and sometimes forests and mountains. Ancestors of the horse five toed.

Odd toed Ungulates.





a. } Even toed Ungulate.
b.

Left fore-foot of Sheep

Fore foot of Red Deer.

Sheep.

Covered with wool, which is greasy, and made of rough scales. The teeth are composed solely of molars, and also incisors, except in the upper jaw; crescent-shaped, no canine. Horns hollow, grow throughout life. Gregarious, climbing. Remarkable for "chewing the cud", the reason for it is that they eat a great amount so that when danger approaches, they can quickly go, and chew the cud at leisure.

Fallow Deer. April 3rd.

Remarkable for ~~flat~~ antlers. Two kinds found in Britain. Young have antlers in second year; feed on clover. 3ft. in height.

Roe Deer. Capreolus capraea.

26 ins. in height, smallest kind of deer. Wild in parts of Scotland. Very pugnacious.

Boar.

Now extinct in Britain since 16th. century.
Very long tusks which continue to grow.
Skull very high at the back.
Live in marshy places, feed on carrion and burrow for roots. Females and little ones live in herds called "sounders", boars live generally by themselves. Very ferocious habits; Indian boar known to attack tigers.
Young speckled and striped.

Cetaceans.

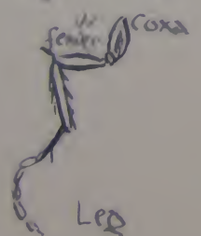
Whales.

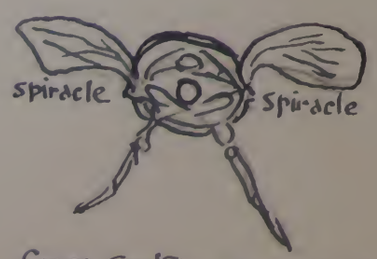
Remote ancestors supposed to have lived on land. Adapted for sea life by possessing four limbs, a tail whose plane is horizontal, differing in this respect from that of a fish. Water taken in by the mouth is allowed to pass out again, every thing contained in it remaining. Now, or very few traces of hair are to be found, a thick layer of blubber to keep its place. The whale is a ~~true~~ mammal because it possesses a similar skeleton, breathing organs (lungs instead of gills), and it is warm blooded.

i8 p69 BOOKCH32

Cockroach – Typical of Insecta –

The Cockroach has an exo-skeleton composed of chitin. Its body is jointed, and formed of the head, thorax and abdomen. The head bears a pair of antennae, three pair of jaws, and in this case two compound eyes, which vary in other insects. The thorax is composed of three segments, 3 pair of legs and 2 pair of wings. It is only the males that have wings, in the female and young they are undeveloped. The abdomen is made of ten segments.
It breathes in air through a small holes or spiracles, on either side of the thorax.
Cockroaches moult three times in the first year, and at that time they are almost white in colour, then the chitin gradually turns dark brown. When the insect first comes out of the larva, its wings are quite limp and wet, but they are composed of tubes which are soon filled with air. The wings appear in the cockroach in the fourth or fifth year.
An insect is distinguished from other jointed animals by being 6 legged, winged, air breathing.





– Cross Section through the thorax –

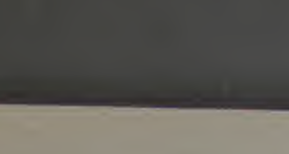
Good Drawings to here

i8 p70 BOOKCH32

– Dragon Fly –

When in the larva, it breathes by means of tracal gills, which are in the form of plates at the end of its body. It breathes in water to the tubes, the oxygen is taken out of it, and the water sent out again.
It does not move about very swiftly, and therefore it does not swim after its prey. So it lies in wait, and then darts out its mask (so called because it folds up and covers the face) and catches its prey in this way.
It feeds on slugs and insects.

seen from beneath mouth covered – by mask –



– Head of larva with mask projected –

– Libellula –

– Fly – very voracious, carnivorous, very big head and eyes, lives on insects, and especially fond of butterflies. It has four powerful, gauze-like wings, which make a good deal of noise when in motion.

Good